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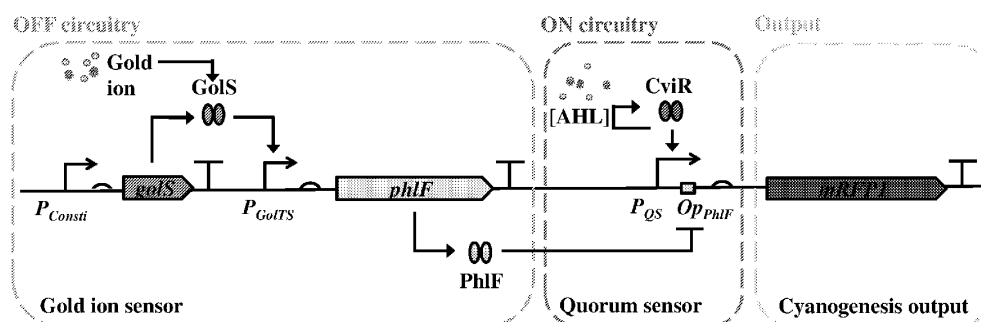
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Figure 15



(57) Abstract: The present invention generally relates to methods of biological reduction of metal-cyanide complexes after metal-cyanidation and methods of biologically hydrolysing cyanide. More particularly, the present invention allows the engineering of an integrated synthetic lixiviant biological system to be housed within a synthetic host (such as the cyanogenic *Chromobacterium violaceum*) for efficient precious metal recovery and toxic metal remediation of electronic waste; with up to four main components/modules in the design and engineering of the synthetic host: 1) synthetic cyanogenesis; 2) synthetic metal recovery; 3) synthetic cyanolysis; and 4) synthetic circuits for lixiviant biology. Bacteria capable of reducing ionic metal to ionic metal (such as gold or silver) as nanoparticles, comprising mercury(II) reductase (MerA) comprising a substitution mutation at position V317, Y441, C464, A323D, A414E, G415I, E416C, L417I, I418D, or A422N, are also disclosed. Processes of synthetic cyanide lixiviant production using genetically engineered bacterium transformed with a heterologous hydrogen cyanide synthase gene and a heterologous 3-phosphoglycerate dehydrogenase mutant gene are also disclosed. Processes of synthetic cyanolysis using a genetically engineered bacterium transformed with a heterologous nitrilase gene are also disclosed.

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